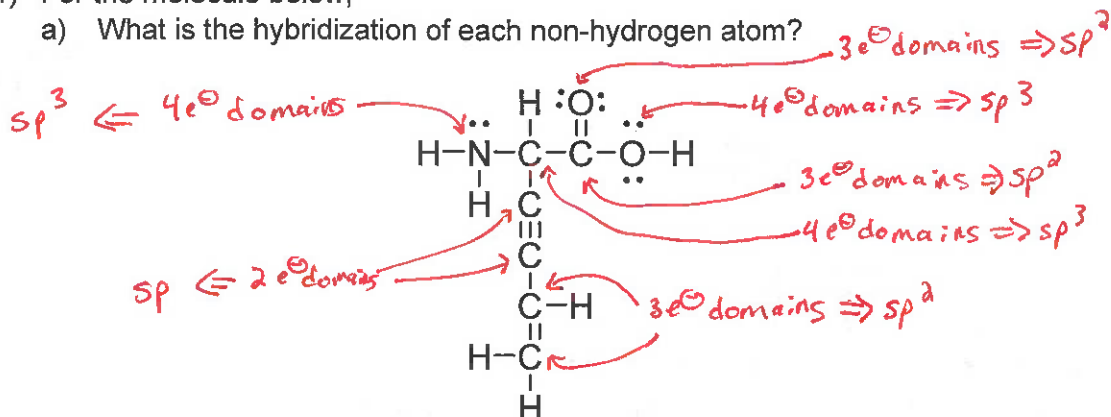


Chapter 9 Review

1) For the molecule below,

a) What is the hybridization of each non-hydrogen atom?

b) How many σ -bonds does it have? 15c) How many π -bonds does it have? 4

d) Which bond between carbons is the strongest?

 $C \equiv C$ triple bond

e) Which bond between carbons is the shortest?

 $C \equiv C$ triple bond

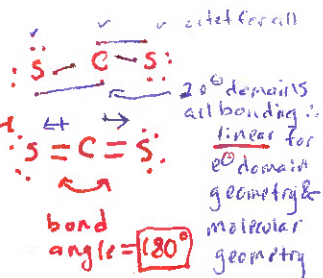
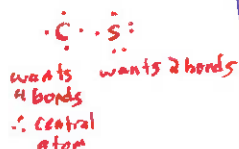
2) For the following molecules,

a) Draw one Lewis dot structure and molecular structure.

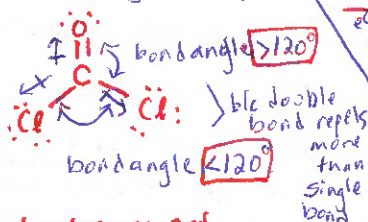
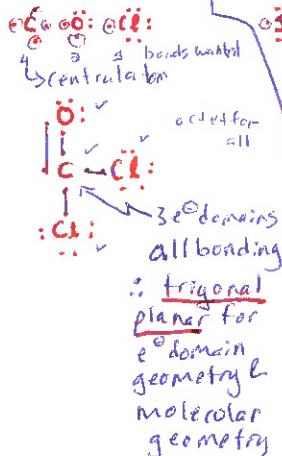
b) Determine the electron domain geometry and molecular geometry for the central atom.

c) What are the bond angles?

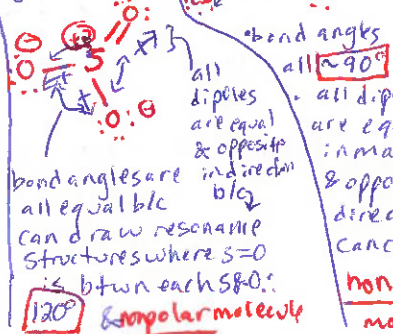
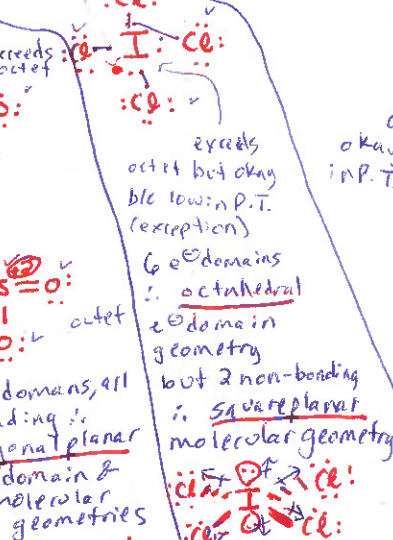
d) Are any of them polar?

CS₂

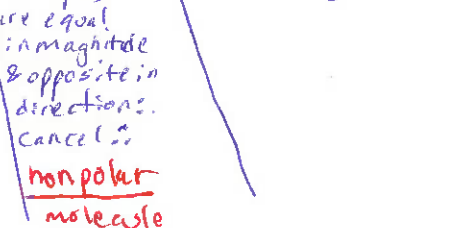
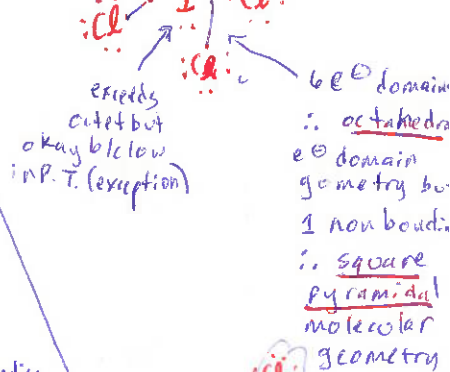
dipoles are equal in magnitude & opposite in direction $\therefore$ cancel $\therefore$ Nonpolar

COCl₂

dipoles are not equal $\therefore$ don't cancel $\therefore$ polar molecule

SO₃ICl₄

120° & nonpolar molecule

ICl₅

Key

left of O so

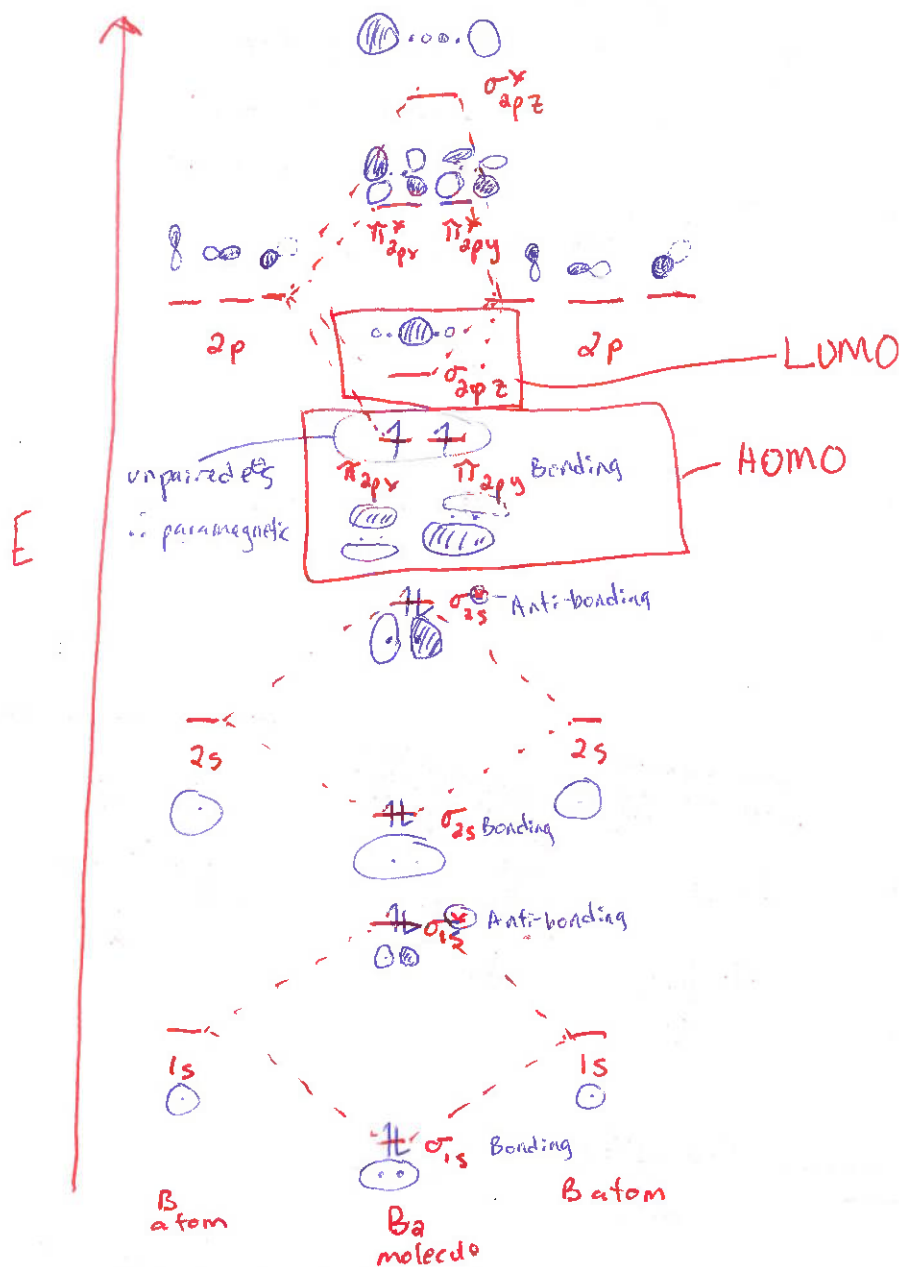
order of σ_{2p} & $(\pi_{2p_x} \& \pi_{2p_y})$ are reversed3) For B_2 ,

a) Draw the full molecular orbital energy diagram.

$$B \quad 1s^2 2s^2 2p^1 \Rightarrow 5e^-$$

$$\times 2$$

$$10 \text{ total } e^-$$



b) Calculate the bond order.

$$\text{Bond order} = \frac{1}{2} (\# e^- \text{ in bonding orbitals} - \# e^- \text{ in antibonding orbitals})$$

$$= \frac{1}{2} (6 - 4) = 1 \text{ single bond}$$

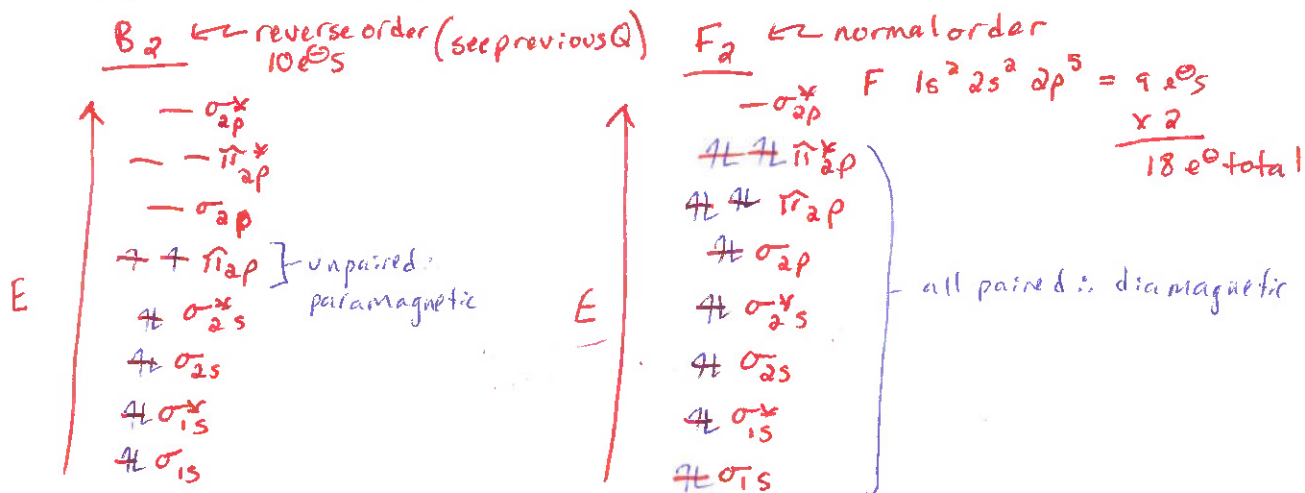
c) Determine its magnetic properties. $\rightarrow$ unpaired e^- $\therefore$ paramagnetic

d) What is the HOMO? LUMO?

$\rightarrow$ Lowest unoccupied molecular orbital (σ_{2p})

$\hookrightarrow$ highest occupied molecular orbital (π_{2p_x} & π_{2p_y})

- 4) Compare the magnetic properties and bond order of B_2 to F_2 . (Hint: use the abridged MO diagram). Which would you predict would be the more stable molecule?



$$B.O. = \frac{1}{2}(6 - 4) = 1 \text{ single bond}$$

$$B.O. = \frac{1}{2}(10 - 8) = 1 \text{ single bond}$$

← Same bond order →

Stability

For: e^- s are in bonding molecular orbital
for HOMO & lower in E

Against: e^- s are unpaired
so more reactive (∴ less stable)

For: all e^- s are paired ∴ less reactive (& more stable)

Against: e^- s are in higher E & anti-bonding orbitals for HOMO